1279. AEC-tr-2331

RADIOCHEMICAL [illegible] FISSION PRODUCTS OF BISMUTH, TH[illegible] BOMBARD-[illegible]

[illegible] Baranov, A. K. Lavrukhina, T. V. Baranova, F. I. Pavlotskaya, A. A. Bragina, and Yu. [illegible] V. Yakovlev. p.97-119 in Meetings of the Division of Chemical Sciences. Session of the Academy of Sciences of the U.S.S.R. on the Peaceful Use of Atomic Energy, July 1-5, 1955. Moscow, Publishing House of the Academy of Sciences of the U.S.S.R., 1955. 378p.

Radiochemical investigations of the products of bombardment of U, Ta, and Bi with 480-Mev protons have revealed similar nuclear processes. There has been observed the production of light elements, fission products, and spallation products in all cases. The detailed investigation of the fission of U, Ta, and Bi with 480-Mev protons has shown that the yield mass curve is symmetrical with one wide maximum. The fission of these nuclei with fast protons does not produce long radioactive chains. There is observed the formation [illegible] elements [illegible] fission of [illegible]

Vinogradov, A.P., Alimarin, I.P. ...

present in the fission of other heavy elements also. The cross section for the fission of U and Th with 480-Mev protons is of the order of geometrical. The cross section for the fission of Bi is significantly lower (7×10^{-26} cm^2). On the average 2 protons and 16 neutrons are emitted before fission of Bi, indicating the emission character of this process [illegible].

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LAVRUKHINA, A.K.

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Investigation of the separation of iron on a mercury electrode with radioactive iron-59. A. K. Lavrukhina. *Primenenie Mechenykh Atomov v Anal. Khim., Akad. Nauk S.S.S.R., Inst. Geokhim. i Anal. Khim.* 1955, 127–32.—The effects of current, temp., time, acidity, and concn. on the pptn. of Fe on Hg electrode were studied. Temp. had the strongest influence. The optimum conditions were 3.4–5 amp., 6.5 v., 1% H_2SO_4, not over 40 ± 3°, and 30 min. The use of Fe^{59} in conjunction with an end-window Geiger-Müller counter enabled the detection of traces of Fe.

M. Hosch

PH

LAVRUKHINA, A.K.

CH

Investigation of the behavior of minute quantities of elements. I. A. K. Lavrukhina (V. I. Vernadskii Inst. Geochem. and Anal. Chem., Acad. Sci. U.S.S.R., Moscow). *Zhur. Anal. Khim.* 10, 203-10(1955).—The pptn., extn., electrolysis, distn., and chromatographic partition of minute amounts of radioelements were studied. The radioisotopes were first purified and then identified by their half-life and β-radiation energy. The results are reported of a study of copptn. of radioisotopes with metal hydroxides and sulfides. The radioisotopes used in OH^- pptn. were Bi^{210}, Ce^{144}, Ce^{141}, and I^{131}. The metals were Bi^{+++}, Fe^{++}, Fe^{+++}, Th^{4+}, La^{+++}, Cr^{+++}, Cd^{++}, Cu^{++}, and Ce^{+++}. NaOH and NH_4OH were used as precipitants. For S^{--} pptn. the Bi and Ce isotopes and Zr^{95} were used. The metals were Bi, Cu, Cd, Pb, and Hg. In the case of OH^- pptn. the copptn. of the radioisotopes did not depend on the soly. of the metal hydroxides; it was greatly affected by the soly. of the isotope hydroxide. Repptn. did not affect the copptn. of radioisotopes forming slightly sol. hydroxides, but it greatly decreased copptn. of the hydroxides of radioisotopes which were sol. Copptn. of Bi^{210} with $Fe(OH)_3$ was not affected by the amt. of $Fe(OH)_3$. Also copptn. of Bi^{210} with various metal hydroxides was very slightly affected by the pH (6.2-10). In the case of sulfide ppts. the radioisotopes forming insol. sulfides copptd. completely with the metal sulfides regardless of the soly. of the latter. Radioisotopes not forming insol. sulfides did not coppt.

M. Hosch

LAVRUKHINA, A. K.

5373
TRANSURANIC ELEMENTS. A. K. Lavrukhina. Priroda 44, 13-20(1955) Dec. (In Russian).
A general review of available data on uranium elements and their analogy to rare element properties are discussed. The 5-f shell actinide hypothesis and the magnetic susceptibility of actinides and lanthanides are analyzed. (R.V.J.)

~~LAVRUKHINA, A.K.~~ LAVRUKHINA, A.K.

CARD 1 / 2 PA - 1804

SUBJECT USSR / PHYSICS
AUTHOR PAVLOCKAJA,F.I., LAVRUCHINA,A.K.
TITLE The Isotope Composition of Rare Earth Elements which were Created on the Occasion of the Fission of Uranium-, Thorium-, and Bismuth Nuclei by 680 MeV Protons.
PERIODICAL Atomnaja Energija, 1, fasc.5, 115-123 (1956)
Issued: 1 / 1957

The present work deals with the results obtained on the occasion of the radiochemical investigation of the isotope composition mentioned above which was carried out in 1954. Hereby particularly the influence exercised by the concentration of the complex-forming reagent and the pH-value of the solution upon the degree of efficiency of the separation of the rare earths was studied. On the occasion of the separation of the totality of rare earths from the products of the bombardment of uranium, thorium, and bismuth by 680 MeV protons, cerium served as a carrier. The authors allow themselves to be guided by the following considerations: The radioisotopes of the various rare earths behave on the occasion of the precipitation of cerium hydroxide, cerium oxalate and cerium fluoride like cerium. The main quantity of cerium can easily be separated from the other rare earths by the oxidation of cerium up to the quadrivalent state with following extraction by diethylether. For separation an ion-exchange column with a diameter of 0,3 cm and a height of 55 cm was used.

Conclusions: The influence exercised by the nature of the complex-forming reagents (ammonium -acetate, -citrate, -oxalate, and -lactate) of the pH-value of the

Atomnaja Energija, 1, fasc.5, 115-123 (1956) CARD 2 / 2 PA - 1804

washing-out solution, and of the rare earth elements upon their degree of separation was investigated. The most effective separation is obtained by washing-out with a 3,6% ammonium lactate solution at pH = 3,4. The isotope parts and the yields of the β-active isotopes of the rare earths on the occasion of the fission mentioned in the heading is determined. The results of the chromatographic separation of these isotopes are shown in form of diagrams. Comparison of the results obtained here with those of other authors permits the conclusion that the yield of the β-active isotopes of rare earth elements (which were created on the occasion of uranium fissioning) does not change when the proton energy is increased from 340 to 680 MeV. There is much to indicate the creation of a hitherto unknown samarium isotope Sm^{141} with T = 20 days. In order to obtain complete data on the fissioning processes, further investigations must be carried out. In this connection, attention must be concentrated on the evaluation of the yield of the isotopes decaying by electron capture.

INSTITUTION:

Name: LAVRUKHINA, Avgusta Konstantinovna

Dissertation: Radiochemical study of nuclear transformations produced by high-energy particles

Degree: Doc Chem Sci

Affiliation: /Not indicated/

Defense Date, Place: 20 Dec 55, Council of Geochemistry and Analytic Chemistry imeni Vernadskiy, Acad Sci USSR

Certification Date: 9 Mar 57

Source: BMVO 13/57

LAVRUKHINA, A. K. and RODIN, S. S.

"Investigated the co-precipitation of francium with different sediments by the short-lived radioactive isotope Fr^{212}."

report presented at The Use of Radioactive Isotopes in Analytical Chemistry, Conference in Moscow, 2-4 Dec 1957
Vestnik Ak Nauk SSSR, 1958, No. 2, (author Rodin, S. S.)

LAVRUKHINA, A. K.

"Some peculiarities of radiochemical analysis."

report presented at The Use of Radioactive Isotopes in Analytical Chemistry, Conference in Moscow, 2-4 Dec 1957
Vestnik Ak Nauk SSSR, 1958, No. 2, (author Rodin, S. S.)

LAVRUKHINA, A.K.

Distr: 4E3d

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Use of radioisotopes in quantitative analysis. A. K. Lavrukhina. *Atomnaya energie* 3, 272-8(1957); cf. C.A. 52, 9681.—Methods reviewed include: neutron absorption, ...

LAVRUKHINA, A. K.

27

Behavior of minute quantities of elements. II. Mechanism of coprecipitation of radioisotopes with hydroxides. 27 A. K. Lavrukhina (V. I. Vernadskii Inst. Geochem.

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Behavior of minute quantities of elements. II. Mechanism of coprecipitation of radioisotopes with hydroxides. A. K. Lavrukhina (V. I. Vernadskii Inst. Geochem. and Anal. Chem., Acad. Sci. U.S.S.R., Moscow). *Zhur. Anal. Khim.* 12, 41-7(1957); cf. *C.A.* 50, 29g.—Copptn. of Bi^{210} and Ce^{144} with Fe, La, Th, and Cd hydroxides was studied at partial and full pptn. of the metal. The proportion of isotope pptd. equaled the proportion of pptd. hydroxide. Some deviations from this were observed when the quantity of pptd. metal was below approx. 20%. Based on these and on ion-exchange expts. it is concluded that upon addn. of precipitant in quantities below the one required for pptn. both the metal and the isotope form micelles having like adsorbed cations. Further addn. of precipitant causes the micelles to coalesce and coagulate. Thus the ratio log ($S_{M(OH)_n}/S_{Is(OH)_n}$), where the numerator is the soly. of the metal hydroxide and the denominator is the soly. of isotope hydroxide is indicative of the extent of copptn. for the given elements when the metal is not completely pptd. If this ratio $\geqq 3$ 20-40% of the metal will drag down 80% of

of isotope hydroxide is indicative of the extent of coppt. for the given elements when the metal is not completely pptd. If this ratio ≥ 3 20–40% of the metal will drag down 80% of the radioisotope. M. Hosch

fra aag

AUTHOR: LAVRUCHINA, A.K., KRASAVINA, L.D. PA - 2193
TITLE: Fission of nuclei of heavy elements by means of high energy particles. (Russian)
PERIODICAL: Atomnaia Energiia, 1957, Vol 2, Nr 1, pp 27 - 35
Received: 3 / 1957 Reviewed: 4 / 1957

ABSTRACT: The present paper deals with radio-chemical investigations of the fission of uranium- thorium-, and bismuth nuclei by means of 680 MeV protons. By means of the interpolation method a complete picture of the fission fragments was obtained.

The interaction of the high energy particles (~100 - 700 MeV) with compound nuclei takes place in two stages: a) The knocking out of fast particles during the collision of the impinging particles with the nucleus. b) The following emission of slow particles from the excited nucleus by evaporation. During these processes the initial nuclei lose a number of nucleons and new nuclei are created, the so-called fission products. They extend over a wide interval of atomic weights, beginning from neighbors of the irradiated elements up to very remote elements. Also during the second stage a fission process may take place. In order to obtain a complete picture of the fission products of U, Th, and Bi by 480 MeV protons, the yields of the stable and non-identified radioactive isotopes were determined from the radio-chemical data obtained by VINOGRADOV et al. (Session

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APPROVED FOR RELEASE: 06/20/2000 CIA-RDP86-00513R000928830008-3"

of the Academy of Science on the peaceful uses of atomic energy, department for chemical science, page 97 (1955)). A diagram illustrates for instance the isotopes created on the occasion of the creation of uranium. The data obtained here result in the following conclusions: On the occasion of the fission of U, Th, and Bi by means of 480 MeV protons, isotopes with surplus neutrons are above all produced. The share of isotopes with a lack of neutrons is insignificant in the case of this proton energy. (The isotopes with a maximum yield are within the range of the isotopes with a neutron surplus and the heavy fission fragments are within the range of nuclear stability) The total fission cross-sections of U and of Th are large, amounting to 55 and 60 % of the geometric cross-section of these nuclei. The fission cross-section of bismuth is 5 % of the geometric cross-section. The probability of the geometric and similar fissions is greatest with bismuth (45 % of the amount of the total fission cross-section). With U and Th this share is somewhat smaller. Finally the distribution of the charge over the fission fragments is discussed. All data and considerations figuring in this tend to show that the fission of U and Th nuclei cannot possibly be explained by pure emission mechanism. This fission is much more likely to be caused

Fission of nuclei of heavy elements by means of high energy particles. PA - 2193

according to a mixed barrier- and emission mechanism.

ASSOCIATION: Not given
PRESENTD BY:
SUBMITTED:
AVAILABLE: Library of Congress

Card 3/3

AUTHOR LAVRUKHINA, A.K., KRASAVINA, L.D., PAVLOTSKAYA, F.I., GRECHISHCHEVA, I.M., PA - 2722

TITLE The Spallation of Copper by 68o-MeV Protons.
(Rasshchepleniye medi protonami s energiyey 68o MeV - Russian)

PERIODICAL Atomnaia Energiia, 1957, Vol 2, Nr 4, pp 345-351, (U.S.S.R.)
Received 5/1957 Reviewed 6/1957

ABSTRACT The investigations described in this paper were carried out in 1954 and they aimed at obtaining a complete picture of the products obtained at the spallation mentioned in the title. Furthermore, the influence of the energy and of the nature of the bombarding particles uponthe character of the spallation process was to be determined. Because it is not possible by means of the radiochemical investigation of the products to identify the stable as well as long-lived and short-lived isotopes, theiryields were estimated with the aid of the interpolation method. The investigations were carried out in metallic copper withvery small admixtures. For one hour the copper plates were exposed to radiation of the innerbundle (protons of 68oMeV) of the synchrocyclotron of the Institute for Nuclear Problems, Academy of Sciences of the U.S.S.R. Then the plates were dissolved in nitric acid, and from thesolution the radioactive istopes of the different elements were separated on isotope carriers. (The following elements were used. Na, P, S, Cl, K, Ca, Sc, Ti, V, Cr, Mn, Fe, Co, Ni, and Cu).
Some conclusions. The total spallation cross section of copper amounts to $0.6.10^{-24}$ cm^2, i.e. $65^o/o$ of the geometrical cross section. The

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main share in the entire production cross section of the spallation products of copper is yielded by the isotopes of Co, Ni and Cu (60°/o). If the stability is increased, the yield of the isotopes also increases. At the spallation of the copper nuclei, protons and neutrons are emitted in almost equal ratio $\Sigma_n/\Sigma_p = 1.3$ .The flying-off of an α-particle is more probable than the successive emission of four nucleons. At spallations of copper by particles of high energy no influence upon the nuclear structurewas noticed. If we compare the characteristic particularities of spallation by protons of 680 MeV with the spallation of copper by different particles of energies ranging from 190MeV to 2.2 BeV, we also obtain some conclusions about the influence of the nature and increase in energy of the bombarding particles upon the charater of the spallation of copper.

ASSOCIATION
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SUBMITTED 10. 10.1956
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LAVRUCHINA, A.K. [Lavrukhina, A.K.]; KOPECKA, L. [translator]

Use of radioactive isotopes in quantitative analysis. Jaderna energie 3 no.9:272-277 S '57.

1. Ustav geochemie a analyticke chemie V.I. Vernadskeho, Akademie ved S.S.S.R.

ЛАВРУХИНА, А.К.

AUTHORS Lavrukhina A.K., Moskaleva L.P., Krasavina L.D., Grechishcheva I.M. 89-10-1/36

TITLE The Forming of Na^{24} and P^{32} when High-Energy Protons Enter into Interaction with Complex Nuclei.
(Obrazovaniye Na^{24} i P^{32} pri vzaimodeystvii protonov vysokoy energii so slozhnymi yadrami - Russian)

PERIODICAL Atomnaya Energiya, 1957, Vol 3, Nr 1o, pp 285-29o (U.S.S.R.)

ABSTRACT The forming cross section for Na^{24} and P^{32} was determined by means of radiochemical methods if Cu, La, Au, Th are bombarded with protons of from 12o to 66o MeV. The following cross sections were measured:

Energy of protons in MeV	Effective cross section in 10^{-29} cm^2							
	Cu		La		Au		Th	
	Na^{24}	P^{32}	Na^{24}	P^{32}	Na^{24}	P^{32}	Na^{24}	P^{32}
12o	0,09	0,07	0,099	-	-	-	-	-
22o	0,22	0,22	0,3	Spu-ren	0,59	Spu-ren	-	-
34o	1,3	1,8	0,5	0,73	0,13	0,3	-	-
48o	5,6	24	2	1,4	3,7	1,1	18	3
66o	25	31	21	-	8,1	2,2	-	-

SUBMITTED May 31, 1957

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LAVRUKHINA, A.K.

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THE ISOTOPIC COMPOSITION OF RARE-EARTH ELEMENTS FORMED BY FISSION OF URANIUM, THORIUM, AND BISMUTH WITH 680-MeV PROTONS. P. I. Pavlotskaya and A. K. Lavrukhina. J. Nuclear Energy 5, No. 1, 149-57(1957).

No. 1, 149-57(1957).

Results are given of a radiochemical investigation of the rare earths formed by fission of U, Th, and Bi nuclei with 680-Mev protons. In this work, which was carried out in 1954, special attention was given to methods of separation of these elements. The influence of various factors on the degree of separation was studied to find the optimum conditions for an ion-exchange chromatographic separation method. These factors were the nature of complexing agents (ammonium acetate, citrate, oxalate, and lactate), the pH of the eluant and the concentration of rare earths. A decay-curve method allowed us to detect radioisotopes of almost all the rare earths and to determine yields of some of them. The formation of a new isotope of Sm with half life approximately 30 days is also proposed. (auth)

LAVRUKHINA, A. K.

11260* (Russian.) Application of Radioactive Isotopes in Quantitative Analysis. Primenenie radioaktivnykh izotopov v kolichestvennom analize. A. K. Lavrukhina. *Zavodskaia Laboratoriia*, v. 23, Mar. 1957, p. ~~298-303~~.

PM fmt any

LAVRUKHINA, A.K.

SPITSYN, V.I.; LAVRUKHINA, A.K., doktor khimicheskikh nauk.

Utilization of atomic energy in Czechoslovakia. Vest. AN SSSR 27 no.6:76-81 Je '57. (MIRA 10:7)

1. Chlen-korrespondent Akademii nauk SSSR (for Spitsyn).
(Czechoslovakia--Atomic energy)

LAVRUKHINA, A.K.

Nuclear reactions in nature. Priroda 46 no.3:24-30 Mr '57.
(MLRA 10:3)

1. Institut geokhimii i analiticheskoy khimii im. V.I. Vernadskogo Akademii nauk SSSR (Moskva).
(Nuclar reactions) (Radioisotopes)

LAVRUKHINA, A. K.

20-1-15/42

AUTHORS: Sekerskiy, S., Lavrukhina, A. K.,

TITLE: Radiochemical Investigation of the Reaction $Si^{30}(p,\pi^+)Si^{31}$ (Radiokhimicheskoye issledovaniye reaktsii $Si^{30}(p,\pi^+)Si^{31}$

PERIODICAL: Doklady AN SSSR, 1957, Vol. 117, Nr 1, pp. 61-64 (USSR)

ABSTRACT: Iniatially it is reported on previous papers on the subject. The present paper thries to ascertain the reaction $Si^{30}(p,\pi^+)Si^{31}$ by radiochemical method. The isotope Si^{31} (T=2,65 hours) can even be ascertained, if its production cross-section is insignificant. In order to demonstrate the existence of the above reaction, the dependence of the cross-section of the production of Si^{31} on the energy of the bombarding electrons in the interval between 12o and 66o MeV was investigated. A 6o to 8o mg weighing target from spectroscopically pure powdery silicon was wrapped into two layers of aluminum foil and irradiated by protons of differently high energy in the interior bundle of the synchrocyclotrone of the laboratory for nuclear problems of the United Institute for Nuclear Research (Ob"yedinennyy institut yadernykh issledovaniy) The methodology of the investigations is discussed; The data here obtained on the value of $\sigma_{Si^{31}}$ at different proton energies are here compared in a table. According to these data $\sigma_{Si^{31}}$ in the area of the proton-energies 12o-22o MeV is hardly changed at all

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Radiochemical Investigation of the Reaction $Si^{30}(p,\pi^+)Si^{31}$. 20-1-15/42

but it is highly increase at an increase of this energy to 220 to 680 MeV. In order to explain this behaviour of $\sigma_{Si^{31}}$, the authors investigate all sorts of reactions of the production of Si^{31} on the occasion of irradiation of silicon by protons. The yield of Si^{31} in the fission of admixtures in the silicon cannot provide an essential contribution to $\sigma_{Si^{31}}$. But the reaction $Si^{30}(d,p)Si^{31}$ doubtlessly takes an important part in the production of Si^{31}. At high energies of the bombarding particles the reaction $Si^{30}(p,\pi^+)Si^{31}$ joins in the process, in which reaction energy-rich positive pions fly off. The cross-section of the reaction $Si^{30}(p,\pi^+)Si^{31}$ can provide an estimation of the yield of pions with the highest energy at the intraction of protons with silicon nuclei. The experiment toascertain the reaction (p,π^+) by the radiochemical method in lage heavy nuclei. (e.g. germanium and bismuth) had no success. There are 2 figures, 1 table, and 14 references, 7 of which are Slavic.

ASSOCIATION: Institute for Geochemistry and Analytical Chemistry imeni V.I. Vernadskiy of the AN USSR(Institut geokhimii i analiticheskoy khimii im.V.I.Vernadskogo Akademii nauk SSSR)
Institute for Nuclear Researche of the Polish AS (Institut yadernykh issledovaniy Pol'skoy Akademii nauk)

20-1-15/42

Radiochemical Investigation of the Reaction $Si^{30}(p,\pi^+)Si^{31}$.

PRESENTED: July 8, 1957, by A. P. Vinogradov, Academician

SUBMITTED: March 5, 1957

AVAILABLE: Library of Congress

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21(1) PHASE I BOOK EXPLOITATION SOV/1762

Lavrukhina, Avgusta Konstantinovna, and Yuriy Alexsandrovich Zolotov
Transuranovyye elementy (Transuranium Elements) Moscow, Izd-vo AN SSSR, 1958. 125 p. (Series: Akademiya nauk SSSR. Nauchno-populyarnaya seriya) 10,000 copies printed.

Sponsoring Agency: Akademiya nauk SSSR. Redkollegiyanauchno-populyarnoy literatury.

Resp. Ed.: P.N. Paley; Ed. of Publishing House: D.N. Trifonov; Tech. Ed.: A.P. Guseva.

PURPOSE: The booklet is intended for the layman interested in nuclear physics and also for physics students at the high school level.

COVERAGE: The booklet describes the transuranium elements, mainly the two most important ones - plutonium and neptunium, and how they were added to the Periodic System. In summarized form the author relates the story of their separation and defines their properties, including some data on their electronic configuration. Various

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Transuranium Elements

SOV/1762

methods of isolation are presented; among them is the method on separating the elements from impure solutions, as well as radiochemical and radiometrical methods. Nuclear reactions serving as synthetic sources for the production of transuranium elements are evaluated in general terms. No detailed description of the chemistry of such reactions is given. Chapter 6 outlines the principles of the chain series and suggests possibilities of predicting new elements. There are 41 references of which 33 are Soviet, 5 English, 2 French, and 1 German.

TABLE OF CONTENTS:

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LAVRUKHINA, A.K.

5(2); 21(5) PHASE I BOOK EXPLOITATION SOV/1900

Akademiya nauk SSSR. Komissiya po analiticheskoy khimii

Primeneniye radioaktivnykh izotopov v analiticheskoy khimii (Use of Radioactive Isotopes in Analytical Chemistry) Moscow Izd-vo An SSSR, 1958. 366 p. [Series: Its: Trudy, t. 9 (12)] Errata slip inserted. 3,000 copies printed.

Resp. Ed.: I.P. Alimarin, Corresponding Member, USSR Academy of Sciences; Ed. of Publishing House: A.N. Yermakov; Tech. Ed.: T.V. Polyakova.

PURPOSE: The book is intended for chemists and chemical engineers concerned with work in analytical chemistry.

COVERAGE: The book is a collection of the principal papers presented in Moscow at the Second Conference on the Use of Radioactive Isotopes. The problems discussed at the Conference included coprecipitation, aging, and solubility of precipitates, determination of the instability constants

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of complex compounds, separation of rare earth metals, and ion-exchange chromatography. No personalities are mentioned. There are 351 references, 175 of which are Soviet, 33 German, 19 French, 8 Swedish, 2 Hungarian, and 2 Czech.

TABLE OF CONTENTS:

LAVRUKHINA, A. K. AND PAVLOTSKAYA, F. I. (Inst of Geochemistry and Analytical Chemistry im V. I. Vernadskiy AS USSR)

"The Chromatographic Method of Separating Promethium From the Fission Products of Uranium"

Isotopes and Radiation in Chemistry, Collection of papers of 2nd All-Union Sci. Tech. Conf. on Use of Radioactive and Stable Isotopes and Radiation in National Economy and Science, Moscow, Izd-vo AN SSSR, 1958, 380pp.

This volume published the reports of the Chemistry Section of the 2nd AU Sci Tech Conf on Use of Radioactive and Stable Isotopes and Radiation in Science and the National Economy, sponsored by Acad Sci USSR and Main Admin for Utilization of Atomic Energy under Council of Ministers USSR Moscow 4-12 Apr 1957.

LAVRUKHINA, A.K.

AUTHORS: Lavrukhina, A. K., Pavlotskaya, F. I., Pozdnyakov, A.A. 78-1-15/43
Grechishcheva, I. M.

TITLE: The Chromatographic Separation of the Radioisotopes of the Elements of Rare Earths by Means of Ion Exchange (Ionoobmennoye khromatograficheskoye razdeleniye radioizotopov redkozemel'nykh elementov).

PERIODICAL: Zhurnal Neorganicheskoy Khimii, 1958, Vol. 3, Nr 1, pp. 82-87 (USSR).

ABSTRACT: Some problems of the aforesaid separation of the isotopes which are formed with nuclear transformation under the influence of particles with high energy are dealt with in the present report. Special attention was paid to the influence of the quantity of the elements on their degree of separation, as well as to the position of the maximum of the chromatographical curve.
Methodics. It was found (reference 1) that the best separation of uranium, thorium, and bismuth was achieved by protons with an energy of 680 MeV by washing out with a 3,6°/o solution of ammonium lactate with pH=3,4. The separation was carried out on cationite "dau-eks -50". Figure 1 shows that the separation was quite effective. Figure 2 shows the same for hafnium. If larger quantities of other elements

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78-1-15/43

The Chromatographic Separation of the Radioisotopes of the Elements of Rare Earths by Means of Ion Exchange.

are present, the separation is not always achieved.
The influence of the quantity of elements on the degree of their chromatographical separation. The dependence of the shape and the position of the maximum of the chromatogram on the quantity of the element. These problems were investigated with yttrium (reference 6). It results from figure 3, which shows the washing out curves without carrier and in the presence of 10 mg yttrium, that the maximum corresponding to various quantities of yttrium are rather far from each other. Consequently, the quantity of the element can influence the position of its maximum on the curve. With low concentrations the maximum is displaced in direction to a more rapid washing out of the respective element. The shape of the maximum is influenced in so far as it is sharper with ultra-low concentrations. The same was proved with the washing out of tetravalent cerium (also in references 3,4,7,9). The data by Senyavina and Tikhonova (reference 8) which obtained wide apexes of curve strontium are incomprehensible in this context. The assertion by the authors on the width of the apex of the curve is not contradictory to the current conception of the theory of exchange-chromatography.
The influence of the quantity of elements on their degree of separation.

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The Chromatographic Separation of the Radioisotopes of the Elements 78-1-15/43
of Rare Earths by Means of Ion Exchange.

The afore-mentioned displacement of the apexes of the curve with the change of concentration can lead to a coincidence of two or more apexes of neighbouring elements. This will reduce the degree of separation in the case of a great difference of their concentrations. This is proved by the example of tullium and ytterbium, which cannot be separated at a ratio of 1.150 (figure 6, curve II). With equal concentrations they can be separated satisfactorily (figure 6, curve I). Further examples are given. From the above examples it can be concluded that the coincidence of the apexes of the curve must be taken into consideration with the determination of the optimum conditions of separation of the elements. This is of great importance with the investigation of the natural radioactivity (e. g. of promethium, samarium and others) in the presence of great quantities of neighbouring elements, as well as with the analysis of irradiated material.
There are 5 figures, and 9 references, 6 of which are Slavic.

ASSOCIATION: Institute for Geochemistry and Analytical Chemistry imeni V. I.

Card 3/4

The Chromatographic Separation of the Radioisotopes of the Elements of Rare Earths by Means of Ion Exchange. 78-1-15/43

Vernadskiy AN USSR (Institut geokhimii i analiticheskoy khimii imeni V. I. Vernadskogo AN SSSR).

SUBMITTED: June 18, 1957.

AVAILABLE: Library of Congress.

Card 4/4

LAVRUKHINA, A.K.

78-1-24/43

AUTHOR: Lavrukhina, A. K.

TITLE: The Search for Promethium in Nature (K voprosu o poiskakh prometiya v prirode).

PERIODICAL: Zhurnal Neorganicheskoy Khimii, 1958, Vol. 3, Nr 1, pp. 129-135 (USSR)

ABSTRACT: In the beginning the author gives a survey of the respective works performed in the years between 1917 and 1949 (ref. 1-5). Principles of the search for radioactive isotopes in nature. The opinion about the lacking of Pm should not be regarded to be definite. The radio-isotopes Pm^{145}, Pm^{147} and Pm^{150} can be searched in natural objects. Thus, already in 1934 (ref. 6) a soft β-activity was observed in carefully purified Nd-samples, which were attributed to a neodymium isotope of $T = 1{,}46.10^{12}$ years. Later on (ref. 7) it was predicted that the isotope Nd^{150} was supposedly contained with a quantity of 5,6% in the natural mixture. The secondary product Pm^{150} of T = 2,7 hours is in equilibrium and therefore can be discovered in natural neodymium. The failure of the search for prometheum isotopes (ref. 5,9,10) can most probably be explained by long lasting separation methods, so that Pm^{150}

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decomposes completely in the mean time. A basis for the search of α-active Pm was only created when about 15 α-active isotopes of rare earths, natural as well as such produced by nuclear reaction with particles of high energy, were determined. There is the possibility to raise the question of the search for Pm^{147} (of T = 2,7 years) in uranium minerals and -ores within which it will form because of a spontaneous decomposition of U^{238}. From the known mass spectrum of these decay products (ref. 15) the Pm^{147} quantity can be calculated, which is in equilibrium with U^{238}. Table 1 contains data on the radiation character of Pm isotopes which can be found in nature as well as on their quantity per 100 g of natural neodymium (for Pm^{150}) and per 100 g of natural uranium (for Pm^{146}). The method of investigation: The following methodical problems should be solved in connection with the Pm-search: 1.- The selection of radiometric methods of measurement of β- and α-activity of weak intensity; 2.- A powerful separation method of Pm from other rare earths; 3.- A method of separation of these elements from others existing in minerals and ores; ad 1.- the intensity of activity as well as the radiation type of Pm isotopes determines the method. The

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determination of Pm^{150} is easily possible with an end-counter (tortsovyy schetchik). Pm^{150} can very quickly be identified by the determination of T and E_{β}. For Pm^{147} this is, however, very difficult and demands the construction of a special counter for weak activities. From the counters described the author selected the 4π-counter which operates in the methane flow under the pressure of 1 atmospheres of absolute pressure. Pm^{145} can be determined by means of photographic plates (ref. 13). Ad 2.- For this the method of ionexchanging chromatography was selected (ref. 16). Weighable Pm quantities were separated from the sum of rare earths, which develop by the U^{235}-separation by means of thermal neutrons through a 3,6 % ammonium-lactate solution at pH = 3,4. The same method was used for the isolation of not-weighable promethium quantities of relatively great quantities of neighbouring elements (oxide mixtures of Er, Tb, Eu, Pr, Nd, Sm and Y, 0,5 mg each irradiated with slow neutrons in a nuclear reactor). Promethium develops as Pm^{149}. Ad 3.- On the one hand we must consider the presence of great quantities of Ca, Mg, Al, Fe and U, and on the other hand the presence of radioactive decomposition

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products of U^{235}, U^{238} and Th^{232}. Table 2 shows the values of the activities of the β-active products of decomposition of the above mentioned elements per 1 kg of uranium ore (content: 10% U, 1% Th). Table 3 gives the activities of α-active isotopes in minerals containing rare earths (U and Th contents, as above, Nd = 1,5, Sm 0,5 %). Before the solution of the problem of separation of rare earths from other elements the reaction of Pm^{147} was studied (table 4). The author worked out a method for the isolation of purely radioactive rare earths (ref. 16) from the products of a bombardment of 1-2 g of natural uranium by protons of high energy. In this all chemical elements were contained (from Na to Np) (ref. 17). After this a method of separation of rare earths from isotopes of other elements (with the exception of actinium) were described. A method is also given for the actinium separation.

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The Search for Promethium in Nature 78-1-24/43

There are 3 figures, 4 tables, and 21 references, 10 of which are Slavic.

ASSOCIATION: Institute for Geochemistry and Analytical Chemistry imeni V. I. Vernadskiy AN USSR (Institut geokhimii i analiticheskoy khimii im. V. I. Vernadskogo Akademii nauk SSSR).

SUBMITTED: June 19, 1957

AVAILABLE: Library of Congress

Card 5/5

AUTHORS: Yerzhabek, V., ~~Lavrukhina, A.K.~~ SOV/78-3-7-40/44

TITLE: The Extraction of Some Rare Earths by Tributyl Phosphate (Ekstraktsiya nekotorykh redkozemel'nykh elementov tributilfosfatom)

PERIODICAL: Zhurnal neorganicheskoy khimii, 1958, Vol. 3, Nr 7, pp 1703-1708 (USSR)

ABSTRACT: Investigations were carried out for the separation of rare earths from larger quantities of uranium, iron, aluminum, magnesium, and calcium by extraction by means of tributyl phosphate. In the present paper the optimum conditions for the separation of small quantities of rare earths by extraction are worked out. A more rapid method for the separation of small quantities of promethium by other elements contained in uranium ores is described. It was found that the presence of uranium in the solution investigated reduces the coefficient of the distribution of rare earths between the tributylphosphate phase and the aqueous phase considerably. It was further found necessary first to separate uranium by ether extraction from the rare earths and then to extract the rare earths by means of tributylphosphate. The extraction of yttrium by

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The Extraction of Some Rare Earths by Tributyl Phosphates SOV/78-3-7-40/44

tributylphosphate was also investigated. The extraction of promethium and other rare earths from accompanying elements by means of tributyl phosphate shows that the increase of nitric acid concentration increases the extraction of rare earths by tributyl phosphate. There are 4 figures, 3 tables and 3 references, 1 of which is Soviet.

ASSOCIATION: Institut geokhimii i analiticheskoy khimii im. V.I.Vernadskogo Akademii nauk SSSR, Institut yadernoy fiziki Chekhoslovatskoy Akademii nauk (Institute of Geochemistry and Analytical Chemistry imeni V.I.Vernadskiy AS USSR, Institute of Nuclear Physics, AS of Czechoslovakia)

SUBMITTED: June 15, 1957

1. Rare earths--Separation 2. Butyl phosphates--Applications

Card 2/2

AUTHOR: Lavrukhina, A. K. (Moscow) 74-27-5-:/6

TITLE: The Present State of Nuclear Chemistry (Sovremennoye sostoyaniye yadernoy khimii)

PERIODICAL: Uspekhi Khimii, 1958, Vol. 27, Nr 5, pp. 517-550 (USSR)

ABSTRACT: In the introduction the author gives a short survey of the investigation of rules governing the nuclear transformation of different chemical elements. This transformation was for the first time in an artificial way performed by Rutherford (Rezerford) in 1919 and the investigation of the rules governing nuclear transformations today belongs to the fundamental problems of the investigation of the structure of matter. In the first section of the present report the author discusses the methods of nuclear chemistry. In the second section the author deals with nuclear reactions occurring under the influence of slow particles: a) nuclear reactions under the influence of neutrons, b) nuclear reactions under the influence of charged particles. In the third section the nuclear fission of heavy elements by slow neutrons is

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discussed. In this connection the authors of many works are cited. The great number of investigations of the nuclear fission products of heavy elements under the influence of slow neutrons permitted the determination of a number of characteristic features of this fission which are given in the present article. In the fourth section the author discusses the nuclear transformations taking place under the action of high-energy particles: 1) nuclear reactions under the influence of fast protons, deuterons, α-particles and neutrons: a) The characteristic features of nuclear fission, reactions, b) the characteristic features of nuclear fission by high-energy particles, c) the emission of light nuclei, d) the secondary nuclear reactions. In the second summary of the same section the author discusses the nuclear reactions under the influence of multiple-charged ions, in the third summary: The nuclear reactions under the influence of γ-quanta, in the fourth summary: The nuclear reactions under the influence of π-mesons and in the fifth summary: The production of new particles. The fifth sec-

tion deals with nuclear reactions in nature. At the end the author states that the examples given in the last section indicate that radioactive and nuclear transformations no doubt play an important part in nature. There are 13 figures and 376 references, 166 of which are Soviet.

1. Nuclear reactions--Theory

AUTHOR: Lavrukhina, A. K. (Moscow) SOV/74-27-10-3/4

TITLE: On the Properties of Francium (O svoystvakh frantsiya)

PERIODICAL: Uspekhi khimii, 1958, Vol 27, Nr 10, pp 1209-1220 (USSR)

ABSTRACT: Early in this paper the author briefly mentions the efforts made to discover the assumed element 87. With the discovery of the short-lived radioactive isotope in the radioactive decay products of uranium by M. Perey francium was given the symbol Fr. From that time scientists started to look for this new element in natural objects. The first chapter of this paper is exclusively devoted to these efforts. It is said among others that already Dobroserdov (Ref 4) had discovered this element and given it the name "russium". A great number of scientists searched for this element 87 in cesium concentrates using the x-ray method (Refs 6-9). The author discusses the work of various scientists (Refs 10-22). The numerous investigations of the decay products of the radioactive elements showed that some radioactive isotopes of francium are either intermediate members of the actinium (Fr^{223}), the neptunium (Fr^{221}) or the thorium (Fr^{224}) series of decay. In the second section the author discusses the properties

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On the Properties of Francium

of the radioactive isotopes of francium. In the course of diverse nuclear reactions until now (except Fr^{223}) 8 radioactive isotopes of francium were obtained (Refs 23-30). In section 3 the author discusses the methods for the separation of francium (Refs 15, 40,41). In section 4 the chemical properties of francium are described (Refs 3,49,41). Section 5 deals with the problem of the separation of francium from the alkali metals. Up to now two methods are known for this separation: the correct co-precipitator (detection) for francium, which could act neither on rubidium nor on cesium; the chromatographic method. This latter method is regarded up to now as the most efficient method in the distribution of the elements with similar chemical properties. In section 6 the ranges for the practical application of francium are discussed (determination of actinium or determination of sarcomae) (Ref 58). In conclusion the author mentions the biological properties of francium (Refs 60-61). The investigation of the practical application of francium is continued. There are 4 figures, 3 tables, and 61 references, 12 of which are Soviet.

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AUTHORS: Pavlotskaya, F. I., Lavrukhina, A. K. SOV/56-34-5-2/61

TITLE: Uranium Fission Products Obtained by 660 MeV Protons in the Range of the Rare Earth Elements (Produkty deleniya urana protonami s energiyey 660 meV v oblasti redkozemel'nykh elementov)

PERIODICAL: Zhurnal eksperimental'noy i teoreticheskoy fiziki, 1958, Vol. 34, Nr 5, pp. 1058 - 1069 (USSR)

ABSTRACT: A target of spectroscopically pure metallic uranium with a weight of 0,5 - 1 g was dissolved in a few milliliters of concentrated hydrochloric acid (which contained from 10 to 20 mg of cerium and of hydrogen peroxide) after having been irradiated in a beam of 660 MeV protons from the synchrotron of the Laboratoriya yadernykh problem Ob"yedinennogo instituta yadernykh issledovaniy (Laboratory for Nuclear Problems at the United Institute of Nuclear Research). The further treatment of this solution is discussed. A diagram illustrates the curves of the washing-out of radioactive isotopes of the rare earth elements, which form in the uranium fission caused by 660 MeV protons. The yields in β^+ - and β^- -active isotopes were determined by a method described before (Ref 3).

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Every peak of the chromatograms was identified by means of the half-life separately for each type of radiation (β^-, β^+, γ) and separately for the different energies of the β- and γ-radiations. The necessary corrections are pointed out briefly. The obtained yields in radioactive isotopes of the rare earth elements are compiled in a table. Based upon the measured and interpolated data the curves of the yield distributions of the various elements versus the mass numbers were constructed. These curves also permitted to extrapolate the yields in the remaining isotopes of the rare earth elements (dysprosium and terbium). The experimental and interpolated data together give a comprehensive conception of the fission products of uranium nuclei by 660 MeV protons in the range of the rare earth elements. The estimation of the share in stable isotopes as well as in isotopes with neutron excess and neutron deficit is also briefly discussed. These 3 types of isotopes form in about the same yield; pertinent details are given. In a short paragraph a report is given on the influence of the shell structure of the nucleus. The evidence obtained from the fission of heavy-element-nuclei by high-energy particles hardly seems to have influenced the presently valid rules govern-

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Uranium Fission Products Obtained by 660 MeV Protons in the Range of the Rare Earth Elements SOV/56-34-5-2/61

ing the distribution of the rare earth elements. The authors express their gratitude to A.A.Sorokin and L.S.Novikov for the identification by means of the γ-radiation and for the computation of the yields of some of the isotopes which decay after the electron capture. There are 8 figures, 3 tables, and 31 references, 15 of which are Soviet.

ASSOCIATION: Institut geokhimii i analiticheskoy khimii Akademii nauk SSSR (Institute of Geochemistry and Analytical Chemistry, AS USSR)

SUBMITTED: October 31, 1957

1. Uranium--Fission 2. Fission fragments--Analysis 3. Rare earth element isotopes (Radioactive)--Determination 4. Chromatographic analysis--Applications

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LAVRUKHINA, A.K.

26-58-6-3/56

AUTHOR: Lavrukhina, A.K., Doctor of Chemical Sciences

TITLE: Achievements of Nuclear Chemistry (Uspekhi yadernoy khimii)

PERIODICAL: Priroda, 1958, 47, Nr 6, p 9-18 (USSR)

ABSTRACT: The discovery of radioactivity opened the way to a new science - nuclear chemistry. Radiochemical research is one of its main characteristics. It determines exactly what kind and quantity of radio isotopes originate from a given nuclear reaction. An important step in the development of nuclear chemistry was the fission of uranium-235 nuclei by thermal neutrons. The studies on the nature of fission products by Soviet scientist V.G. Khlopin and his assistants are a valuable contribution in this field. The past ten years have been characterized by the development of nuclear reactions of fast moving particles, pi-mesons, gamma quanta and multicharged ions. Great steps have been recently made in the study of new isotopes of rare earth-elements. Radiochemical methods also facilitated the study of the spectra of tantalum, holmium and lanthanum fission products. As to new transuranic elements, neptunium, americium and fermium were synthesized in reactions with slow neutrons and several other new elements were discovered.
There are 7 diagrams, and 14 references, 10 of which are

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Achievements of Nuclear Chemistry 26-58-6-3/56

Soviet and 4 English.

ASSOCIATION: Institut geokhimii i analiticheskoy khimii imeni V.I. Vernadskogo Akademii nauk SSSR (Moskva) (Institute of Geochemistry and Analytical Chemistry imeni V.I. Vernadskiy of the USSR Academy of Sciences) (Moscow)

Card 2/2

1. Chemistry-USSR 2. Nuclear chemistry-Development
3. Radiochemistry-Research

AUTHORS: Lavrukhina, A. K., Krasavina, L. D., Pozdnyakov, A. A. 20-119-1-14/52

TITLE: Radiochemical Investigation of the Products Resulting From the Fission of Lanthanum by 660 MeV Protons (Radiokhimicheskoye issledovaniye produktov deleniya lantana protonami s energiyey 660 MeV)

PERIODICAL: Doklady Akademii Nauk SSSR, 1958, Vol. 119, Nr 1, pp. 56-58 (USSR)

ABSTRACT: The short introduction reports on previous works dealing with the same subject. This work gives some results of the radiochemical investigation mentioned in the title. The main difficulty of this investigation was the production of the fission products of lanthanum in pure radioactive form. The investigation was performed at the synchrocyclotron of the Laboratory for Nuclear Problems (Laboratoriya yadernykh problem) of the United Institute for Nuclear Research (Ob"yedinennyy institut yadernykh issledovaniy). The target, which was to be bombarded, consisted of lanthanum oxide powder with a weight of up

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Radiochemical Investigation of the Products Resulting From the Fission of Lanthanum by 660 MeV Protons

to 1g; it was wrapped into an aluminium foil. These targets were irradiated by 660 MeV-protons for from 1-2 hours. Then the powder was dissolved in hydrochloric acid and subsequently the radioactive isotopes were separated. For the separation of the fission products of lanthanum a method for the rapid chromatographic separation of Mn, Fe, Co, Ni, Cu and Zn was worked out before. The essence of this method is shortly described here. The here obtained experimental data and the computed cross sections are compiled in a table and indicate the following: In the fission of lanthanum isotopes with a neutron surplus are essentially generated. The isotopes are in the wide interval of the atomic numbers from Z = 15 to Z = 40. A diagram illustrates the distribution of the yields of the fission products of lanthanum on the atomic number. This distribution has the character of a flat curve, which speaks for the high probability of the symmetrical and also of the unsymmetrical fission. This conclusion agrees with the theory, after which for nuclei with average atomic weight (A 160), for which $(Z^2/A)/(Z^2/A)_{before}$ 0.6 holds, the barrier in asymmetrical

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Lavrukhina, Avgusta Konstantinovna

Uspekhi yadernoy khimii (Advances in Nuclear Chemistry) Moscow, Izd-vo AN SSSR, 1959. 143 p. (Series: Akademiya nauk SSSR. Nauchno-populyarnaya seriya) Errata slip inserted. 20,000 copies printed.

Resp. Ed.: I.P. Alimarin; Ed. of Publishing House: D. N. Trifonov; Tech. Ed.: Yu. V. Rylina.

Sponsoring Agency: Akademiya nauk SSSR. Redkollegiya naucho-populyarnoy literatury.

PURPOSE: This book is for chemists, physicists, and, more especially, teachers and students of courses in nuclear chemistry.

COVERAGE: The book offers a historical sketch of the development of nuclear chemistry and the fundamental concepts of nuclear reactions as they apply to the transformation of chemical elements. The

general characteristics of radioactive disintegrations and nuclear reactions are described, and basic models of atomic nuclei and theories on nuclear forces are reviewed. Consideration is also given to descriptions of radiochemical methods of studying nuclear transformations, which methods include beta-, alpha-, and gamma-spectroscopy, scintillation counting, use of photographic emulsions, etc. The role of slow particles in nuclear reactions and the influence of these particles on fission processes in heavy elements are discussed, as well as nuclear transformations caused by high-energy particles. Reaction products are also considered. Nuclear reactions on the sun, stars, and in space are described, and attention is given to the role of radioactive transformations in changes in the composition of isotopic elements of the earth's crust. The practical application of the principal advances in nuclear chemistry is reviewed with special emphasis on nuclear reactions which yield isotopes of transuranic elements and atomic power. Finally the problem of systematically classifying the nuclei of radioactive isotopes is considered. There are 28 figures, 4 tables and 26 references, all Soviet. No personalities are mentioned.

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LAVRUKHINA, A.K.; KOURZHIM, V.; FILATOVA, L.V.

Determination of actinium in natural objects from the daughter product Fr^{223}. Radiokhimiia 1 no.2:204-207 '59. (MIRA 12:8)

(Actinium--Analysis) (Francium--Isotopes)

LAVRUKHINA, A.K.; CHZHU PEY-TSZI [Chu P'ei-chi]

Dependence of the distribution coefficient (organic phase - aqueous phase) on the concentration of the distributed elements. Radiokhimiia 1 no.5:530-537 '59. (MIRA 13:2)

(Extraction)

LAVRUKHINA, ~~A.K.,~~ doktor khimicheskikh nauk

Radioisotopes in the earth's crust. Khim.nauka i prom. 4 no.4: 472-478 '59. (MIRA 13:8)
(Radioisotopes)
(Geochemistry)

21(7)

AUTHORS: Lavrukhina, A. K., Grechishcheva, I. M., Khotin, B. A. SOV/89-6-2-6/28

TITLE: Radiochemical Investigation of Nuclear Reactions Producing Pions (Radiokhimicheskoye izucheniye yadernykh reaktsiy, privodyashchikh k obrazovaniyu π-mezonov)

PERIODICAL: Atomnaya energiya, 1959, Vol 6, Nr 2, pp 145 - 151 (USSR)

ABSTRACT: The experimental part of the work was carried out with protons of an energy of 110 - 660 Mev, which had been accelerated in the synchrocyclotron of the OIYaI (Joint Research Institute of Nuclear Physics). The targets were irradiated with different proton flux radii for 1.5-2 hours. The proton ray intensity was determined by means of an aluminum monitor, wherein the $Al^{27}(p,3pn)Na^{24}$ cross section was assumed to be 10 mb. The identification of radioisotopes and the cross section determination were carried out according to the method described in reference 3. The copper target was 25.7.0.5 mm^3 high, the La_2O_3-target weighed 50 - 200 mg and the copper target 400-800 mg. All elements were spectrally pure. After proton irradiation

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the samples were dissolved in a 50% solution of HNO_3, $2N HNO_3$, and aqua regia, respectively. The radioisotopes were separated from the solutions, i.e. nickel from copper, barium from lanthanum and platinum from gold. The cross sections measured may be seen from the following tables:

	σ in $10^{-30} cm^2$	
	E_p = 480 Mev	E_p = 660 Mev
$Si^{30}(p,\pi^+)Si^{31}$	2.2	4.0
$Cu^{65}(p,\pi^-)Ga^{66}$	0.34	-
$Cu^{65}(p,p\pi^+)Ni^{65}$	2.0	3.4
$La^{139}(p,p\pi^+)Ba^{139}$	Not observed	
$Au^{197}(p,p\pi^+)Pt^{197}$	Not observed	
$Cu^{65}(p,2\pi^+)Ni^{66}$	Not observed	

Radiochemical Investigation of Nuclear Reactions Producing SOV/89-6-2-6/28
Pions

E_p (Mev)	σ (in 10^{-29} cm^2)	
	Ga^{66}	$Cu^{65}(p,\pi^-)Ga^{66}$
130	1.30 ± 0.15	-
190	2.0 ± 0.2	0.6
250	3.1 ± 0.2	1.8
350	4.40 ± 0.25	3.1
480	3.5 ± 0.2	2.2

The experiments permit the following conclusions to be drawn:
1) The cross section of the reaction (p,π^+) in heavy nuclei is in the order of 10^{-30} cm^2, the production of the π^+-meson being more probable than that of the π^- meson. The ratio is:

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$$\frac{\sigma(p,\pi^+)}{\sigma(p,\pi^-)} = 6.5.$$

2) The reaction $(p,p\pi^+)$ is more probable than the reaction (p,π^-). That agrees well with the data hitherto available on the nature of nuclear reactions caused by highly energetic particles. The high cross section (Ref 2) of the reaction (p,π^+) in silicon can be explained only by the occurrence of the reaction (d,p) in addition to the reaction mentioned. 3)In the proton energy increase from 480 to 660 Mev a slow cross section increase of the reactions $(p,p\pi^+)$ and (p,π^+) was observed. S. Sekerskiy separated the Ni^{66}-nucleus from the irradiated copper target. There are 5 figures, 3 tables, and 16 references, 12 of which are Soviet.

SUBMITTED: July 14, 1957

LAVRUKHINA, A.K.

GINZBURG, F.L.

21 (0), 5 (0)

SOV/89-7-2-17/24

AUTHOR: Shchebetkovskiy, V. N.

TITLE: All-Union Symposium on Radiochemistry (Vsesoyuznyy simpozium po radiokhimii)

PERIODICAL: Atomnaya energiya, 1959, Vol 7, Nr 2, pp 175-176 (USSR)

ABSTRACT: A symposium was held in Leningrad from 3 to 5 March 1959. More than 200 participants from different institutes in Moscow, Leningrad, Kiyev, Novosibirsk, Tbilisi and Gor'kiy attended it. Twentyeight papers were read. The following are mentioned: I. Ye. Starik: On the problem of the molecular state of micromasses of radioactive elements in solutions: I. Ye. Starik, N. I. Ampelogova, F. L. Ginzburg, L. I. Il'menkova, I. A. Skul'skiy, L. D. Sheydina: Condition of radioactive elements occurring in microconcentrations of solutions (Zr, Am, Pa, Po). M. N. Yakovleva, M. A. Shurshalina: Application of the dialysis method for examination of uranium carriers in natural bodies of water. V. I. Paramonova, Ye. F. Latysheva. Complex formation of the multivalent ruthenium with chlorine ions. K. B. Zaborenko, A. Ye. Zaval'skaya, V. V. Fomin: Determination of the composition and the instability constants by ion exchange of the cerium oxalate complexes. A. I. Moskvin: Complex formation of plutonium and americium with the anions of

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ethylene diamine tetra acetic acid (EDTA) and oxalic and phosphoric acid. A. V. Trofimov, L. N. Stupanova: A new method for the determination of ion charges of radioactive elements in solutions by application of ion exchanging resins of different swelling capacities. N. B. Vysokoostrovskaya, A. V. Trofimov, B. N. Nikol'skiy: Confirmation of the non-existence of complex formation between potassium and EDTA by application of the ion exchange and the potentiometric methods. V. M. Vdovenko, Ye. A. Smirnova: Determination of the conditions of compounds to be extracted in the organic phase (hydration of uranyl nitrate with ester). V. M. Vdovenko, N. V. Aleksandrova: Degree of hydration of nitric acid in dibutyl ether of the diethylene glycol. V. M. Vdovenko, A. S. Krivokhatskiy: Degree of solvation of the nitric acid in the dibutyl ether of the diethylene glycol. A. K. Lavrukhina: Determination of the dependency of the distribution coefficients between the organic and the watery phases in order to determine the condition of the substance in the solution and to fixate the concentration range at which complex formation starts. V. I. Kuznetsov, P. N. Palei lectured on extraction of hexavalent tungsten with aniline from hydrochloric media. An. N. Nesmeyanov on substitution of hydrogen in benzol by the recoil

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atoms P^{32}, As^{76} and Sb^{124}. B. G. Dzantiyev lectured on the recoil atoms from the reactions of $Li^{6}(n,\alpha)T$, $N^{14}(n,p)C^{14}$ in a medium of cyclic hydrocarbons. V. I. Arismukhin lectured on the influence of the NO_3 and H^+ ions on the reduction velocity of hexavalent plutonium under the influence of its own α-radiation. In the course of thorough discussions it was established that the comprehension of the condition of radioactive elements in solution are of eminent importance for the whole range of radio chemistry. More studies have to be made in this field as were made before. A better coordination of all the institutes which are occupied with this problem will yield good results in the future.

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AUTHORS: Lavrukhina, A. K., Pozdnyakov, A. A. SOV/89-7-4-15/28

TITLE: The Spallation of Hafnium by Protons With Energies of 660 Mev

PERIODICAL: Atomnaya energiya, 1959, Vol 7, Nr 4, pp 382-384 (USSR)

ABSTRACT: It is the aim of the present paper to determine the yields of spallation products and to investigate some details of the interaction between 660 Mev-protons and hafnium nuclei. The chromatographical separation of the spallation products, calculation of β^--, and β^+-yields, and of the K-capture isotopes was carried out according to methods which have already been described in publications. On the basis of experimental and interpolated data for all identified elements the curves for the dependence of isotopes on their mass numbers were then constructed. In the spallation of hafnium by 660 Mev-protons the isotope-distribution functions are cupola-shaped like in the distribution of the spallation products of copper. In the case of hafnium the cupolas are considerably shifted in the direction of the nuclei with neutron-deficit. In the spallation of hafnium nuclei with neutron-deficit are essentially produced. They comprise 67% of the total spallation cross section.

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The Spallation of Hafnium by Protons With Energies of 660 Mev

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23 and 10% respectively correspond to the portion of stable nuclei and to nuclei with a neutron surplus. The cupola-shaped curve with $Z = 64$ is shifted towards smaller masses and lower yields (compared to the adjoining elements). This may be explained according to the statistical theory by the influence of the closed subshell with $Z = 64$. From the cupola-shaped curves the summated isotope-production cross sections are then determined. The total cross section for the processes of hafnium nucleus spallation is $1.5 \cdot 10^{-24} cm^2$. This amounts to 85% of the geometric cross section of the hafnium nuclei. In the fraction of lutetium there is an activity with the half-life of 4 hours, which may be attributed to the new isotope Lu^{168}. The second diagram shows the dependence of the cumulative yield of the isobars on the number N of the departed nucleons. This yield remains constant at $N \leqslant 20$ and decreases at $N > 20$ according to the exponential law $\ln \sigma_A = PA + const$. Here $P = 0.11$ holds. For the isotope with $N > 20$ the production cross section of a given product-nucleus may be calculated according to the formula by S. Rudstam (Ref 6):

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The Spallation of Hafnium by Protons With Energies of 660 Mev

$\sigma(A_i, Z_i) = \exp\left[PA-Q-R(Z_i - SA_i)^2\right]$. Here $P = 0.11$; $Q = 12.8$; $R = 1.2$; $S = 0.433$ holds for the parameters. A table contains the numbers of neutrons and protons (determined by estimation), which were emitted in the spallation of hafnium. The results obtained indicate a considerable increase of the number of evaporated neutrons with increasing atomic number of the irradiated nuclei. The number of cascade neutrons remains nearly constant. The average excitation energy of the hafnium nuclei is 150 Mev. There are 2 figures, 1 table, and 7 references, 4 of which are Soviet.

SUBMITTED: February 13, 1959

Card 3/3

LAVRUKHINA, A.K., doktor khim.nauk (Moskva)

Transuranium elements. Nauka i zhyttia 9 no.7:21-23 Jl '59. (MIRA 12:11)
(Transuranium elements)

24.6600
3.1530
~~24 (7)~~

66910

AUTHOR: Lavrukhina, A. K. SOV/74-28-11-2/5

TITLE: The Role of Nuclear Processes in the Formation of Chemical Elements

PERIODICAL: Uspekhi khimii, 1959, Vol 28, Nr 11, pp 1310-1342 (USSR)

ABSTRACT: In the present paper, an attempt is made to investigate some points of the theory of the synthesis of elements on stars on the basis of experimental data concerning the course of various nuclear reactions. To solve the problem of formation of elements, data on the distribution of chemical elements and their isotopes on various celestial bodies are of high importance. In 1889, Clarke (Ref 1) first tried to find a relation between the relative distribution of elements in the earth's crust and their atomic numbers. After him, numerous research workers tried to obtain more exact data on the distribution of elements (Refs 2-19). So far, only a small number of cosmic bodies, mainly atmospheres of some stars of our Galaxy, have been investigated. Nevertheless, it appears possible to draw some conclusions regarding the fundamental laws of distribution of chemical elements in the cosmos. Figures 1 and 2 give the curves of distribution of atomic

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The Role of Nuclear Processes in the Formation of Chemical Elements

nuclei according to atomic numbers and mass numbers, corresponding to data in reference 10. According to the author's opinion, the cases of deviation from the average distribution of the elements are also important for the solution of the problem of their formation. The most significant cases are given (Refs 10, 15-17, 20-51). The theories of formation of chemical elements may be divided into 2 groups (Refs 52-57). The former includes the theories of formation of atomic nuclei at thermodynamic equilibrium of the initial system (Refs 20, 54, 58-74). The main deficiency of these theories is that the reason of "freezing" of the thermodynamic equilibrium of the system, in which the nuclear processes take place, is not yet clarified. Besides, the problem concerning the cosmic bodies, in which the stabilization of equilibrium must take place, remains unsolved. The second group includes theories of the synthesis of atomic nuclei in non-equilibrium systems (Refs 41, 52, 55, 75-87). According to data of modern astrophysics, there is no cosmic body with such a high temperature and density of particles as is demanded by non-equilibrium theories. Recently,

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research workers have tried to find non-eqilibrium synthesis reactions of atomic nuclei which proceed at temperatures lower than in the systems with thermodynamic equilibrium (Refs 52, 75-80). These theories, however, can only explain a few rules of cosmic distribution of elements but not the formation of all chemical elements. Better prospects are offered by the theory recently developed by the American physicists Fowler, Salpeter and Greenstein as well as by the English astrophysicists E. M. Burbidge, G. R. Burbidge and Hoyle (Refs 41, 55, 81-86). According to this theory, the synthesis of elements takes place at any stage of development of the cosmos in close relation with nuclear processes which explain the energy and illuminating power of cosmic bodies, their evolution, and the change in their chemical composition. In this theory, the cosmic distribution need not be explained by the assumption of any preastral stage of the cosmos. The formation process of chemical elements takes place during the whole period of existence of the metagalaxy, being a regular process combined with the evolution of stars which still continues. Further, the principal features of nuclear processes are discussed which

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give rise to the formation of elements in the stars, and which are postulated in the theory of star synthesis. Besides, some proofs are offered which were obtained in the investigation of nuclear reactions in accelerators (Refs 88-162). The available data on the synthesis of chemical elements which takes place in the course of some stages of development of stars in nuclear processes, and on the subsequent variation of their isotope composition during the straying of cosmic radiation in the interstellar space indicates that there is no doubt some connection between astrophysical, radioastronomic, and nuclear physics data. The whole of the nuclear processes investigated offers a qualitatively good explanation both for the average cosmic distribution of elements and for the few considerable deviations in the content of some elements in various cosmic bodies. In order to obtain a general idea of the processes which give rise to the formation of chemical elements, new data on the chemical composition of a number as large as possible of cosmic bodies will be of decisive importance. The following Soviet scientists are mentioned in the present paper: G. I. Pokrovskiy, V. V. Cherdyntsev,

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The Role of Nuclear Processes in the Formation of Chemical Elements SOV/74-28-11-2/5

L. E. Gurevich, A. P. Zhdanov. There are 16 figures, 11 tables, and 162 references, 58 of which are Soviet.

ASSOCIATION: In-t geokhimii i analiticheskoy khimii im. V. I. Vernadskogo AN SSSR (Institute of Geochemistry and Analytical Chemistry imeni V. I. Vernadskiy AS USSR)

Card 5/5

21 (8) SOV/20-125-3-18/63

AUTHORS: Lavrukhina, A. K., Revina, L. D., Rakovskiy, E. Ye.

TITLE: The Functions of the Excitation of Fragments of the Fission of Lanthanum (Funktsii vozbuzhdeniya oskolkov deleniya lantana)

PERIODICAL: Doklady Akademii nauk SSSR, 1959, Vol 125, Nr 3, pp 532-534 (USSR)

ABSTRACT: In the present paper the authors try to investigate the excitation functions of the fission fragments P^{32}, Ni^{66}, and Se^{73} of lanthanum in the energy range 140 - 660 Mev of the bombarding protons. The investigations were carried out by means of the synchrocyclotron of the Ob'yedinennyy institut yadernykh issledovaniy (United Institute of Nuclear Research). Powders of lanthanum oxide (covered by an aluminum foil) were irradiated for 0.5 - 1 hour. After the irradiation, the lanthanum oxide was dissolved in concentrated hydrochloric acid, and the radioactive isotopes of nickel, selenium, and phosphorus were removed on isotope carriers. The removal of Se, Ni, and P is

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discussed in detail. The results of these experiments are shown in two diagrams which show the excitation functions of the fragments Se^{73}, Ni^{66}, and P^{32} of the fission of lanthanum in the energy range 140 - 660 Mev of the incident protons. These results are the average values of 2 - 4 parallel experiments. For Se^{73} at E_p = 140 Mev and for P^{32} at E_p = 220 Mev only a very low activity (~5 pulses/min) was observed, which permits the determination of the production thresholds of these nuclei (E_{thresh} ~ 100 Mev for Se^{73} and E_{thresh} ~ 200 Mev for P^{32}). The nuclei investigated by the authors are interesting since 2 of them have a neutron excess (P^{32} and Ni^{66}) and the nucleus Se^{73} has a neutron deficit. The characteristic sharp ascent of the curves $\sigma = f(E_p)$ for P^{32} and Se^{73} beyond the threshold of their production (if the energy of the protons increases)

The Functions of the Excitation of Fragments of the Fission of Lanthanum SOV/20-125-3-18/63

is indicative of a significant increase of the probability of the asymmetric fission of lanthanum nuclei in the investigated energy range. The excitation function of Ni^{66} has a somewhat different character. The cross section of the production of Ni^{66} varies by 10 times if E_p rises from 140 to 660 Mev. The probability of the symmetric fission of lanthanum nuclei in a lower degree depends on the energy of the incident protons. This fact explains also the constancy of the cross section of the fission of silver in the interval $E_p \sim 300 - 660$ Mev. The method of the thick-layer photo-plates applied in the present paper does not permit the recording of the products of a strongly asymmetric fission. A further investigation of the excitation functions of the fission of the nuclei of the middle part of the periodical system is very important for the explanation of the fission mechanism. The authors thank L. P. Moskaleva and M. I. Blokhina for their help in the carrying out of the present investigation. There are 2 figures and 14 references, 5 of which are Soviet.

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The Functions of the Excitation of Fragments of the Fission of Lanthanum SOV/20-123-3-18/55

ASSOCIATION: Institut geokhimii i analiticheskoy khimii im. V. I. Vernadskogo Akademii nauk SSSR (Institute of Geochemistry and Analytical Chemistry imeni V. I. Vernadskiy of the Academy of Sciences USSR)

PRESENTED: December 10, 1958, by A. P. Vinogradov, Academician

SUBMITTED: December 5, 1958

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24.6600
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68158

AUTHOR: Lavrukhina, A. K.

SOV/20-129-6-21/69

TITLE: The Problem of the $(p,\pi^{\pm})$ Reactions 19

PERIODICAL: Doklady Akademii nauk SSSR, 1959, Vol 129, Nr 6, pp 1277-1278 (USSR)

ABSTRACT: It was possible to determine the reactions $Si^{30}(p,\pi^{+})Si^{31}$ and $Cu^{65}(p,\pi^{-})Ga^{66}$ at proton energies of from 200 to 660 Mev by means of the radiochemical method. This fact is in contradiction to the present conceptions of nucleon-nucleon interactions within the range of high energies. The possibility of the development of reactions in which only one pion departs in each case follows from the data on the energy spectra of the charged mesons produced in a collision between 670-Mev protons with carbon nuclei. The spectra of the positive and negative pions have a maximum in the energy range of ~110 Mev and extend to 400 Mev. These spectra may possibly extend even farther, viz. to the maximum energy value possible (470 Mev) corresponding to the reaction $C^{12}(p,\pi^{+})C^{13}$. The development of the $(p,\pi^{\pm})$ reactions may possibly be explained according

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The Problem of the (p, $\pi^{\pm}$) Reactions SOV/20-129-6-21/69

to the theory of peripheral collisions. The most interesting data for the purpose of explaining (p, $\pi^{\pm}$) reactions are those of Kh. P. Babayan, N. L. Grigorov, et al. (Ref 6), according to which 10^{11} - 10^{12} ev particles use up their entire energy for the production of mesons in their interaction with iron nuclei. In this case there is no successive interaction of the primary particle with the nucleons of the nucleus or with their complexes, for the primary nucleon collides with the meson cloud, and therefore the probability of the departure of mesons is great. At lower energies (up to 1 Bev) the probability of such peripheral collisions is very small, and they can be detected only by employing very sensitive methods. The (p, $\pi^{\pm}$) reactions observed by the author on complex nuclei have a very small cross section and may apparently be examples of peripheral collisions in this energy range. Therefore, reaction investigations carried out on other complex nuclei, in which pions fly off, as well as further investigations of the angular distribution and energy distribution of their products will render better understanding of the interaction processes of high-energy particles with complex nuclei possible.

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SOV/20-129-6-21/69

The Problem of the $(p, \pi^{\pm})$ Reactions

There are 6 Soviet references.

ASSOCIATION: Institut geokhimii i analiticheskoy khimii im. V.I.Vernadskogo Akademii nauk SSSR (Institute of Geochemistry and Analytical Chemistry imeni V. I. Vernadskiy of the Academy of Sciences of the USSR)

PRESENTED: August 19, 1959, by A. P. Vinogradov, Academician

SUBMITTED: August 11, 1959

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LAVRUKHINA, A.K.

~~LATYSHEV, G.D.~~

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PHASE I BOOK EXPLOITATION SOV/5410

Tashkentskaya konferentsiya po mirnomu ispol'zovaniyu atomnoy energii, Tashkent, 1959.

Trudy (Transactions of the Tashkent Conference on the Peaceful Uses of Atomic Energy) v. 2. Tashkent, Izd-vo AN UzSSR, 1960. 449 p. Errata slip inserted. 1,500 copies printed.

Sponsoring Agency: Akademiya nauk Uzbekskoy SSR.

Responsible Ed.: S. V. Starodubtsev, Academician, Academy of Sciences Uzbek SSR. Editorial Board: A. A. Abdullayev, Candidate of Physics and Mathematics; D. M. Abdurasulov, Doctor of Medical Sciences; U. A. Arifov, Academician, Academy of Sciences Uzbek SSR; A. A. Borodulina, Candidate of Biological Sciences; V. N. Ivashev; G. S. Ikramova; A. Ye. Kiv; Ye. M. Lobanov, Candidate of Physics and Mathematics; A. I. Nikolayev, Candidate of Medical Sciences; D. Nishanov, Candidate of Chemical Sciences; A. S. Sadykov, Corresponding Member, Academy of Sciences USSR, Academician, Academy of Sciences Uzbek SSR; Yu. N. Talanin,

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Transactions of the Tashkent (Cont.) SOV/5410

Candidate of Physics and Mathematics; Ya. Kh. Turakulov, Doctor of Biological Sciences. Ed.: R. I. Khamidov; Tech. Ed.: A. G. Babakhanova.

PURPOSE: The publication is intended for scientific workers and specialists employed in enterprises where radioactive isotopes and nuclear radiation are used for research in chemical, geological, and technological fields.

COVERAGE: This collection of 133 articles represents the second volume of the Transactions of the Tashkent Conference on the Peaceful Uses of Atomic Energy. The individual articles deal with a wide range of problems in the field of nuclear radiation, including: production and chemical analysis of radioactive isotopes; investigation of the kinetics of chemical reactions by means of isotopes; application of spectral analysis for the manufacturing of radioactive preparations; radioactive methods for determining the content of elements in the rocks; and an analysis of methods for obtaining pure substances. Certain

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instruments used, such as automatic regulators, flowmeters, level gauges, and high-sensitivity gamma-relays, are described. No personalities are mentioned. References follow individual articles.

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Brodskiy, A. I., I. P. Gragerov, I. F. Franchuk, L. V. Sulima, I. I. Kukhtenko, V. A. Lunenok, A. S. Fomenko, and A. M. Aleksankin [Institut fizicheskoy khimii AN SSSR - Institute of Physical Chemistry AS USSR]. Investigation of the Mechanism of Oxidizing Reactions by the Isotopic Method 327

Lavrukhina, A. K. [Institut geokhimii i analiticheskoy khimii im. V. I. Vernadskogo AN SSSR - Institute of Geochemistry and Analytical Chemistry imeni V. I. Vernadskiy AS USSR]. Methods of Modern Radiochemistry and the Fields of Its Application 334

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LAVRUKHINA, A.K.; MOSKALEVA, L.P.; MALYSHEV, V.A.; SATAROVA, L.M.;
SU KHUN-GUY [Su Hung-Kusi]

Angular distribution of Na^{24} nuclei and fission fragments in the interaction of high energy protons with nuclei of gold and uranium. Zhur.eksp.i teor.fiz. no.3:994-995 Mr '60. (MIRA 13:7)

1. Institut geokhimii i analiticheskoy khimii Akademii nauk SSSR.
(Sodium--Isotopes) (Protons) (Nuclear reactions)

24.6600

22460
S/186/60/002/001/014/022
A057/A129

AUTHORS: Lavrukhina, A.K.; Rodin, S.S.

TITLE: Radiochemical investigation of uranium fission products obtained by 660 Mev proton bombardment

PERIODICAL: Radiokhimiya, v. 2, no. 1, 1960, 83 - 93

TEXT: Fission and spallation products of uranium obtained by bombardment with 660 Mev protons were investigated radiochemically. From experimental data and results obtained by interpolation a full chart of residual nuclide products is prepared and basic regularities in their formation are determined. High-energy fission was discovered in 1947 by G.T. Seaborg et al. [Ref. 1: Phys. Rev. 72, 740 (1947)]. The present authors started in 1955 detailed radiochemical investigations of fission products (in the interval Z = 78 - 93) obtained by 660 Mev proton bombardment of uranium. Comparison with literature data on fission products of copper and bismuth can give information concerning the dependence of fission characteristics on the atomic number of the target-element (from Z = 29 up to Z = 92). M. Linder and R. Osborn's paper [Ref. 12: Phys. Rev., 103, 378 (1956)] on fission products obtained by 100 - 340 Mev proton bombardment of ura-

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nium in connection with the present results may give some informations on the effect of the bombardment energy in the range of 100 - 660 Mev on the yield of some fission and spallation products. In the present work metallic uranium foils (0.3 - 0.5 g) were bombarded in a circulating 660 Mev proton beam of the synchro-cyclotron in the laboratoriya yadernykh problem Ob'yedinennogo instituta yadernykh issledovaniy (Laboratory for Nuclear Problems of the Joint Institute of Nuclear Investigations), varying the duration from 15 min to 2 h. After irradiation the uranium foils were dissolved in HNO_3 or HCl adding H_2O_2, the elements Pt, Au, Hg, Tl, Pb, Bi, Po, At, Fr, Ra, Ac, Th, Pa, U and Np were separated by chemical processes and identified by their radioactive properties. Activity measurements were carried out with a standard end-window counter [of MCT-17 (MST-17) type] and scintillation counter with ZnS(Ag) crystal. In the obtained uranium fission and spallation products 42 nuclides in the interval of A = 188 - 237 with a half-life T from 20 min to 140 days were identified (see Table 1). Relatively high yield of neutron-excess nuclides was observed. Data were obtained by interpolation. From the experimental and interpolation results distribution curves according to the mass number were plotted (Fig. 4) and it was demonstrated that nuclides with maximum yield are distributed close to nuclear stability curve. Distribution curves for the elements $Z < 90$ are not in agreement with the previously observed

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tendency [Ref. 3: GYeOKhI AN SSSR, M. (1955); Ref. 5: Atomnaya energiya, 2, 345 (1957); Ref. 9: Atomnaya energiya, 2, 27 (1957); Ref. 8: T.V. Malysheva, I.P. Alimarin, ZhETF, 35, 5, 1103 (1958)] of the increasing probability for the formation of neutron-deficient nuclides with increasing n/p ratio in the bombarded nuclei. Even more surprising are the values calculated for neutron and proton emission as 5.2 or 11.7, i.e., $\sum n/\sum p = 2.3$. Thus the probability of proton emission in uranium spallation is relatively high being half of the probability of neutron emission. The present authors assume that these effects are caused not only by the contribution of spallation processes, but by the greater cross section of the fragmentation process on uranium in comparison with other heavy elements [such as Au or Bi, see A.K. Lavrukhina et al., Ref. 18: Atomnaya energiya, 3, 285 (1957)]. From the yield distribution curves (Fig. 4) formation cross sections were determined, summary yield curves were plotted (Fig. 7) and thus the total fission cross section of uranium was estimated at 0.4 barn. According to Lindner (Ref. 12) after 340 Mev proton bombardment uranium fission cross section is 0.28 barn, not considering the contribution of Fr, Rn, At, Po, Bi, Pb, Tl, Hg, Au and Pt. From the present data it can be seen that the contribution of these elements is about 40% of the total fission cross section. Their formation cross section decreases twice in the energy range from 660 to 340

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Radiochemical investigation of uranium fission....

Mev. Thus the total fission cross section of uranium in 340 Mev bombarding is about 0.35 barn and remains constant in this proton energy range. However, formation cross sections of single fission products change considerably with increasing proton energy. The yield of Th, Ac and Ra, for instance, increases with the proton energy while the yield of U and Pa decreases (see Table 2). Decrease in U and Pa yield is explained by the fact that with increasing proton energy the mean excitation energy increases, but the probability of the transfer of a smaller part of the energy from protons to the nucleus decreases. Since U and Pa are formed at relatively small excitation energies, their yield decreases. The range of applicability of S.G. Rudstam's formula [Ref. 21: Phyl. Mag., 44, 1131 (1953)] was checked comparing the experimental curve of dependence of the cumulative yield of isobars on the number of emitted nucleons (Fig. 9) with the theoretical curve calculated by J.D. Jackson [Ref. 17: Can. J. Phys., 35, 21 (1957)]. The difference between the two curves demonstrates that emission of α-particles and fission possibility of residual nuclei must be considered in the calculation of uranium fission products yield. It was observed that the experimental yield of Po^{210} (N = 126) is about three times less than the interpolated value (Fig. 4). In previous investigations by I.A. Yutlandov [Ref. 6: RIAN SSSR, L. (1956)], A.N. Murin, I.A. Yutlandov [Ref. 7: Izv. AN SSSR, OKhN, 4, 408 (1957)] and A.K.

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Radiochemical investigation of uranium fission....

Lavrukhina, A.A. Pozdnyakov [Ref. 22: Atomnaya energiya, 7, 382 (1959)] the effect of shell structure on the yield of residual nuclei was also noticed. Decrease in yield of nuclides with closed shells can be explained by the static theory of nuclear reactions. The present authors thank the coworkers in the laboratory L.M. Satarov, G.V. Perfeyev and M.I. Blokhin for the help as well as V.N. Mekhedov and V.G. Solov'yev for discussing the present paper. There are 9 figures, 2 tables and 22 references: 11 Soviet-bloc and 11 non-Sviet-bloc.

SUBMITTED: April 10, 1959

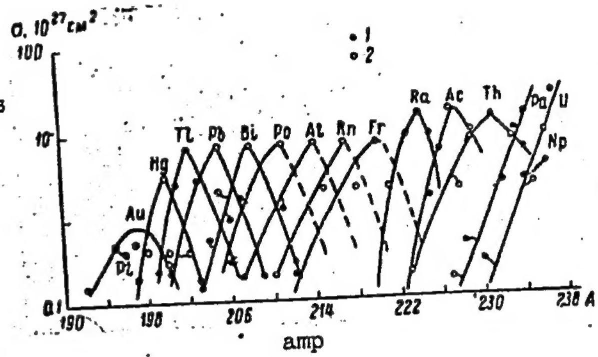

Figure 4: Distribution curves of the yield of isotopes of different elements according to mass number in uranium fission with 660 Mev protons. 1 - experimental values; 2 - interpolated values.

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LAVRUHINA, A.K. [Lavrukhina, A.K.]

Role of nuclear processes in the formation of chemical elements.
Analele chimie 15 no.3:3-42 Jl-Ag '60. (EEAI 10:2)
(Chemical elements) (Nuclear reactions)

KOURZHIM, V.; LAVRUKHINA, A.K.

Precipitation of alkali metals with certain triheteroacids.
Zhur.anal.khim. 15 no.3:272-276 My-Je '60.
(MIRA 13:7)

1. V.I.Vernadsky Institute of Geochemistry and Analytical Chemistry, Academy of Sciences, U.S.S.R. Moscow and Institute of Nuclear Physics, Academy of Sciences, Chechoslovakia, Prague.
(Alkali metals) (Acids)